The objective of m is to convert **the log evaluation's ∅ and a*Rw**, into the log evaluation's estimate of Ro (water saturated formation resistivity), not the core analysis version of Ro or the ''true'' Ro. The objective here is to make the log analysis report the reservoir saturation. m is an internal log analysis parameter. If it fails to generate Ro from log data (not core data) it is not fit for purpose and in the real world is ''wrong''. The laboratory is an inadequate analogy of in-situ conditions primarily because the scale of lab m is cm whilst the scale of the logged Rt, with which it will be used, is metre or possibly dm. The unspoken assumption of log analysis ''equations'' is that inputs have come from the same piece of rock, which they have not if the rock is inhomogeneous and the scales of measurement of the inputs differ. This is most blatantly the case with SCAL m and logged Rt in heterolithic facies.

With certain water zones (Sw100 zones from side-walls, cuttings and chromatograph), spanning a range of ∅ in rocks of the same rock type (similar ∅-k crossplots) we have access to the log data's actual value for Ro and m – what we need. We choose to ignore Nature's own reservoir conditions m laboratory and try to create reservoir conditions in the laboratory. Why? This particular faith in core data is misconceived.. m must predict the log data's Ro not the lab data's Ro.

Consider the detailed objective of each step and focus on the data that will actually be used in the evaluation.

Saturation Exponent n. Function and Calibration

The objective of n is to convert **the log evaluation's value of Ro/Rt** into the actual reservoir Sw. The log evaluations metre scale estimate of Rt/Ro departs from the lab's cm scale measurement of Rt/Ro as heterogeneity increases. The value of n is determined by the n definition plot, commonly seen in core analysis reports, such that n is the negative slope of Log(Sw) vs. Log(Rt/Ro). This plot is conventionally populated by core data with an Rt/Ro axis not measured at the scale of the log data which will actually be used in the evaluation. No wonder we get wrong answers with log analysis!

This n definition plot can be used more effectively if we consider the detailed objective and focus on the data that will actually be used in the evaluation. The approach of this author is to determine n by populating the n definition plot with sensible data. This is **not** cm scale core data unless we are lucky enough to be dealing with a metre scale homogeneous ‘‘blocky sand’’ for example.

Don’t be fooled into thinking you have the ‘‘right’’ answer for m and n just because you have done core SCAL analysis. Think. For more information consult with our experts for **petrophysics courses** & training details.